

ART. VIII.—*On Cholera Asphyxia*. By JAMES F. GAYLEY, M. D., of Philadelphia.

IN a former number of this Journal (January, 1849), we discussed the etiology of intermittent and remittent fevers, and the following were our conclusions.

1st. That the lungs and the liver are the great decarbonizing organs of the body; that their function being complementary, the activity of that function is always in an inverse ratio.

2d. That, during winter, the lungs, from the part they perform in the generation of animal heat, are the more active organ. On the other hand, in summer the liver is the more active.

3d. That exposure to a low temperature repels the blood from the surface to the internal organs. If this exposure takes place in winter, the lungs being then the active organ, the heat of the congestion falls on some part of the respiratory apparatus; hence we have catarrh, bronchitis, pleurisy and pneumonia as the prevailing diseases.

4th. But if this exposure takes place in summer, the liver being then in a state of stimulation, the force of the congestion falls on it. It becomes deranged, involving all those organs, more or less, whose blood has to pass through the liver to reach the heart. Hence we have hiliary affections, as intermittents, remittents, dysentery, diarrhoea and cholera, as the prevailing diseases.

5th. That the pulmonary diseases of winter and of cold climates, and the hepatic diseases of summer and of warm climates, are both produced by the same agents acting on the system. The different effects being solely owing to the different modifications of the agents, and the different conditions of the system when exposed to their influence; and we might with as much truth say, that malaria was the cause of the one as of the other.

The truth of the first proposition is evident from a reference to the function of the lungs and liver in the inferior orders of animals, and in the *fetus in utero*. In the reptilia, the blood from the inferior extremity and the viscera is decarbonized by the liver, while that from the upper extremity passes through the lungs. In the *fetus*, during the period of intra-uterine life, the liver does the whole of the decarbonizing labour, the lungs being inactive until birth.

But this process of decarbonization subserves two other very important purposes. In the lungs it is the source of animal heat; in the liver it forms a fluid very important in the process of digestion. Accordingly, we find the normal temperature of air-breathing animals proportional to the amount of decarbonization performed by the lungs, and it is highest in those in which the whole of the blood passes through this organ, as in the mammalia and birds. The second proposition, therefore, follows immediately from the first,

and may be considered a corollary to it, viz., "that during winter, the lungs, from the part they perform in the generation of animal heat, are the more active organ. On the other hand, the liver is the more active in summer."

The third proposition we will pass over as having no direct bearing on the subject under discussion.

The fourth proposition we believe to be a very important one. It lies at the foundation of a proper understanding of all the diseases peculiar to the tropics, and to the warm season of temperate climates. In the article above alluded to, we endeavoured to follow it out in one direction, and to show how, under certain circumstances, it gives rise to intermittent and remittent fevers. Our object in the present article is to follow its workings in another direction, as the cause of cholera.

The blood from the stomach, small and large intestines, has to pass through the liver to reach the heart. The condition of the circulation in the alimentary canal, therefore, depends very much on the condition of the circulation in the liver. We know that in plants, so long as healthy action is going on in the leaves, the fluid taken up by the roots flows onward regularly. But if we arrest this action by shutting out the light and modifying the state of the atmosphere, the circulation ceases, although it is propelled by a constant endosmotic force *à tergo* of from one to three atmospheres. If we let in the light, and restore the normal condition of the atmosphere, the circulation is renewed. So in the portal circulation. While the liver cells perform their functions properly, the blood moves on regularly through the capillaries of the stomach and bowels; and these perform their functions in a healthy manner. But if any of the liver cells become deranged in such a manner that the normal function is not performed, we will have an effect produced in that portion of the portal circulation, which passes through them, similar to what we found in the circulation of the plant, when the function of the leaves was interfered with, viz., an arrest of the onward current. But the cœliae, mesenteric and hemorrhoidal arteries continue to pump in their usual quantity; "the supply is greater than the demand, and we have a glut in the market," viz., congestion. We have no anastomosing branches here through which this impeded blood can get around the liver, and thus reach the heart. Nature, however, has made provisions in the spleen for remedying this state of things for a time; so long as the spleen is able to accommodate the superfluous blood no bad results follow. But this state of things continuing, the spleen becomes at length filled; the engorgement extends to the splenic vein, thence to its tributary the inferior mesenteric; and from the inferior mesenteric to the vascular rete that lines the colon. Now, we know that whenever an obstruction to the venous circulation exists *à fronte*, an exudation of the serum takes place through the walls of the distended vessels. If we apply a ligature around the arm, so as to impede the circulation towards the heart, all the parts beyond the ligature become œdematosus from the exudation of the serum of the blood in the distended vessels into the cellular tissue. In

the congested state of the vascular rete of the colon, this exudation takes place into the colon and gives us diarrhoea.

Such is the effect produced by the derangement of a portion of the liver cells. But the same agencies that produce an arrest of function of part of the organ may, under certain circumstances, act with such intensity as to arrest the function of the whole. And what will be the consequence? A little reflection will tell us that the stomach, small and large intestines, will in a short time be in a state of extreme congestion. With this we will have increased sensibility (irritability), and an exosmose of the watery portion of the blood of the congested part into the stomach and bowels. As it passes, it will wash away the epithelial scales of the mucous membrane. The increased sensibility in the stomach produces vomiting; in the bowels, frequent stools; and these stools consist of the washed off epithelial scales mixed with the exuded serum, and present the appearance of rice water. In short, we have *cholera asphyxia*.

The rapid arrest of the function of an organ of such importance as the liver, being the largest gland in the body, and the withdrawal of such a quantity of serum from the circulation, will produce changes in the character of the blood sufficient to account for the other symptoms met with in the disease.

The state of the blood drawn in different stages of the disease, and post-mortem examinations, favour the view here advanced. A circular letter on the former subject was addressed by the Medical Board of the British Army to thirty medical officers stationed in the Madras Presidency. The disease prevailed at most of the military stations, during portions of the years 1819-20-21-22. "It was established by replies to this letter, as well as by an immense amount of concurrent evidence, that the blood of persons affected with cholera is of an unnaturally dark colour and thick consistence. Those appearances were very uniformly expressed by the terms dark, black, tarry in regard to colour; and by thick,ropy, syrupy, semi-coagulated in respect to consistence. The change in the condition of the blood is likewise proved to be in the ratio of the disease; the blood at the commencement seeming to be nearly or altogether natural, and more or less rapidly assuming a morbid state as the disease advanced." (*Johnston on Tropical Climates*, p. 355.) These are just the results that might be expected from the suspension of the function of the liver, and the consequent copious exudation of serum from the radicals of the *vena portarum*.

The post-mortem examinations made by the English army surgeons, in the East Indies, give the following results—"In the abdominal cavity, the peritoneal covering of the viscera present in general but little variation from the healthy standard; occasionally, indeed, the morbid accumulation of blood in the vessels of the viscera, imparting an appearance of turgidity and blueness, is evident even on their exterior surface. We also find them bearing marks of inflammation, especially when the patient may have lingered long before death. In other cases, the whole tube has had a blanched appearance, both

internally and externally. . . . The liver has been commonly found to be gorged with blood, but not always. . . . *The vessels of the mesentery have been very generally found to be uncommonly full of blood.*" (*Op. cit.* pp. 359, 360.

The Philadelphia College of Physicians appointed Drs. Jackson, Neill, H. H. Smith and Pepper, a committee to make post-mortem examinations of persons having died of cholera during its prevalence here last summer. The following is taken from their report.

"1. In the recent subject, the peritoneal coat, like all the serous membranes, was in all remarkably dry. The lubricating serosity was deficient in the serous membranes.

"2. The epithelial layer of the intestinal mucous membrane was in all the specimens either entirely removed, or was detached, adhering loosely as a pulpy layer mixed with mucus or an albuminoid substance.

"3. *Peyer's glands* were developed to a greater or less extent in all the cases examined.

"4. The *solitary glands* were also developed, and contained in the recent subject a minute quantity of white substance.

"5. The *villi* were denuded of their covering, but unchanged in other respects.

"6. The *capillaries* were entire, and manifested no departure from their normal state."

In addition to the above, I learn from Dr. Neill, who conducted the investigations, that the proper tissue of the liver was exanguious; but that the large blood-vessels were gorged with blood. This was also the condition of all the large blood-vessels of the abdominal viscera.

The engorgement of the large vessels of the intestines is given in both reports. The report of the English army surgeons is not clear in regard to the state of the liver. We know that the organ is composed of cells, which are the organ proper; the parenchymatous structure, which holds the cells—the little livers—together; and the ramifications of the portal vein, which are only a mechanical arrangement to supply the cells with the fluid out of which to elaborate their proper secretion. In making post-mortems, these distinctions ought to be kept in view. In the report under consideration they were overlooked. Doctor Neill's examinations were conducted with more discrimination. He found the proper structure of the organ exanguious, but the blood-vessels supplying it gorged. The appearance of the capillaries observed by Dr. Neill admits of an easy explanation. We have seen above, the *thickening* of the blood that takes place during the progress of the disease, and that this change is proportional to the time the disease has existed, and its intensity. Before death, this exists to such a degree as to prevent the blood from entering the capillaries. These, by virtue of the contractility of their walls, keep up a pressure on their contents, causing exudation, and this exudation continues until they regain their normal size. That the blood is too thick to enter

the capillaries is evident, from the large vessels being gorged with it. The appearance presented by the serous membranes in those cases examined by Dr. Neill may be accounted for, by the intense congestion arresting the normal vital action of the part, and substituting one purely physical—the exudation into the cavity of the canal in the direction in which the least resistance is offered; and this carries before it the epithelial layer of the mucous membrane, which gave the appearance presented by this membrane in the examinations. Without following out the principle any further in explaining the minutiae of the appearances presented, we will merely say that slight variations in the appearances presented after death do not militate against the theory here advanced. No agent, even if it acts uniformly, will produce precisely the same effects on all constitutions. But the cause of the disease here advocated (the arrest of the function of the liver) may exist in various degrees, from that of a few cells to the whole organ. In the details of the appearances presented after death, as well as the symptoms presented during life, we might expect a great variety. But there would be certain leading points in which they would all agree, "*Facies non omnibus una, nec diversa, sed talis decet esse sorores.*" And these points of agreement we have found in the gorged conditions of all the large blood-vessels of the portal system.

The principles of treatment are obvious. The great desideratum is to unlock the secretions of the liver by setting the cells to work. The question is how can this best be done? The experience of the profession proves to us that nothing will do this so well as calomel. This must be our sheet-anchor in this terrible malady. My plan during the past summer was to give it in doses of from ten to twenty grains, at intervals varying from half an hour to two hours, mixed with a little sugar, and laid on the tongue, and washed down with a little ice-water. I prefer this way of administering it, because it is rarely if ever thrown off. When given in pill or suspended in syrup, the irritability of stomach is such that it is apt to be ejected, before the material with which it is mixed can be dissolved by the liquors of the stomach; but when given as above, it almost invariably remains, and acts like a charm in quieting the irritability of the stomach. In connection with this, I used sinapisms to the abdomen and extremities, and frictions with dry flannel, with a view of determining the blood to the surface and thus diminishing the supply to the viscera *à tergo*, while the calomel was creating a demand *à fronte*. This I kept up until the equilibrium of the circulation was restored. In regard to the dose, the quantity given above is only an approximation, as I seldom weighed it. My custom was to carry a vial of calomel always with me, so that when called to a case no time might be lost in sending for it. I poured out what I considered the dose required for the case before me, and administered it as detailed above. Some may object to what appears to be a wholesale mode of giving calomel; and well they might, if the mucous membrane of the stomach was in a normal state. But let it be remembered that it is being loosened and washed away by the constant serous exudation. This, in

connection with the fulness of the blood-vessels, will interfere with the process of absorption. It is probable, therefore, that only a portion, and in some cases a very small portion, is absorbed. These doses were given only until the violence of the attack was broken. The number required to produce this effect varied from two to five. No bad consequences followed the use of the mercury. In one case slight ptyalism was produced, which yielded readily to the usual treatment.

In some cases the convalescence was rapid. In others, there remained a state of system characterized by considerable thirst, jactitation, debility, and occasional watery yellowish stools. This yielded to small doses varying from one-fourth to one grain, three times a day. With several of these I tried an acidulated solution of quinia, but the stomach would not tolerate it. At a later period, however, when the function of the liver was re-established, as indicated by the improved stools and the disappearance of the thirst and jactitation, I found quinia to have a very happy effect.

Such was my treatment of the disease during the past summer. Out of thirty-five cases, thirty-two recovered. Some of them were very bad cases. The three that died were beyond the reach of remedies when I was called. There was no pulse at the wrist, and sinapisms had no more effect than if applied to a dead person. In such a state of system, it is to be presumed that internal remedies would be as inert as external applications. This presumption is strengthened when we call to mind the tendency of the disease to destroy the mucous membranes. I never used opiates, camphor, brandy, capsicum, chloroform, or any of the thousand-and-one remedies recommended in this disease. Their multiplicity proves their inefficiency. The spasm and debility I looked upon as the effect of the state of things detailed above, and I considered that the best antispasmodic and the best stimulant which would start the cells of the liver to work. There is much sound philosophy in the aphorism of the father of medicine, "*sanguis solvit spasma*." If we get rid of the congestion and equalize the circulation, the spasm will disappear.

It affords me pleasure to append the following extract from the second annual report of the medical department of the Siam mission of the Presbyterian church, located at Bangkok, dated October 1st, 1849, and signed by Dr. Honse, detailing his treatment of cholera during its recent visitation to that city, as it agrees in a remarkable manner with my own. He says:—

"With a thousand dying daily on his right hand and on his left, for weeks together, as may be imagined your missionary physician found abundant occupation, though the smitten people, palsied with fear, seemed to deem it useless to contend with death, and, at first, comparatively few bethought themselves of the foreign doctor, or appeared to think his or any art could avail. Nor, indeed, would it, save perhaps to check the complaint in its earliest and forming stage, had not a gracious Providence been pleased to direct his mind, perplexed and wavering, among the multiplicity of opposite remedies advised, to one simple course of treatment for the disease, which

soon evinced such results that no other was thought of or required. This course consisted in the administration of *calomel in large doses*; a scruple or even forty grains being given at the outset, followed up at intervals of half an hour or an hour, with other scruple doses of the same remedy till relief was obtained. From one to four were generally required, though as many as seven have been given, and in one case two hundred and sixty grains were taken before the disease was subdued. Of course, unless the disease was most unequivocally marked, and admitted of no delay, milder means, such as mixture of laudanum and essence of peppermint, thirty drops each in a wineglassful of water, with external applications, were at first resorted to, and would often prove successful; but these failing to arrest the symptoms, no time was lost in giving the grand remedy.

"Your physician's experience with calomel, given as above stated, and *before the pulse had ceased* at the wrist, inclines him to look upon it almost as a specific for the cure of epidemic cholera. But two cases out of forty-five, to whom it was thus administered, disappointed his hopes; all the rest recovering, though many of them were not severely attacked. Nor did any apparently evil consequences seem to result from the exhibition of these immense doses of calomel, beyond a moderate salivation, and from this even several were exempt." (*Foreign Missionary*, Feb. 1850.)

In conclusion, I will take the liberty of saying that my treatment was the *result* of the opinion I had formed of the *cause* of the disease; and this opinion was reached by following out the principle expressed in proposition 4th, quoted at the beginning of this article. It was not a thing of accident, but a conclusion arrived at by philosophical induction.

ART. IX.—*Notice of certain Peculiar Bodies observed in the Human Subject.*
By JOSEPH LEIDY, M. D. [With five wood-cuts.]

In the winter of 1845, while engaged dissecting a human subject, I observed, deposited in some of the tissues, certain bodies of a character totally different from any others known to me. Since then up to the present time, during the course of every winter, I have noticed the same kind of bodies in several white, more or less emaciated subjects, in the dissecting-room of the University of Pennsylvania. They are of a yellow-cream colour, very irregular in form, and vary in size from half a line up to one-fourth of an inch. The tissues in which they are found are the papillary layer of the dermis, the areolar tissue, and the voluntary muscles.

In the papillary layer of the dermis, the course of deposit of the matter composing the bodies is in some measure determined by the lines of the papillæ tactus, as is indicated in Figure 1, which represents one of these bodies deposited in a portion of the papillary layer of the dermis from the palm of the hand. Wherever the deposit exists, the papillæ tactus are obliterated.